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# Aspects of vocal behaviour, including seasonality of song, of diurnal forest raptors in the Guineo-Congolian region

by Françoise Dowsett-Lemaire

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**Aspects du comportement vocal (dont la saisonnalité des chants) chez les rapaces forestiers de la région guinéo-congolaise.** Des observations accumulées sur une vingtaine d'années montrent que, parmi les rapaces forestiers rencontrés en Afrique centrale et occidentale, trois espèces sont particulièrement vocales : l'Autour tachiro *Accipiter tachiro* (toutes races confondues), le Serpentaire du Congo *Dryotriorchis spectabilis* et l'Aigle couronné *Stephanoaetus coronatus* ; l'Aigle-autour de Cassin *Spizaetus africanus*, l'Autour à longue queue *Urotriorchis macrourus* et le Gymnogène d'Afrique *Polyboroides typus* chantent moins fréquemment. Le Serpentaire du Congo et l'Autour à longue queue chantent la plupart du temps d'un perchoir, et surtout en début de matinée, avec une petite resurgence en fin de journée. L'Autour tachiro chante parfois posé mais surtout en vol, principalement dans la première demi-heure suivant l'aube. Les rapaces plus lourds et à grand territoire (Aigles couronné et de Cassin) chantent en parades aériennes concentrées pendant les heures chaudes du milieu de journée. L'Autour tachiro et le Serpentaire du Congo sont des chanteurs nettement saisonniers, avec une saison qui dure souvent cinq à six mois. Le comportement d'autres espèces moins vocales ou d'occurrence plus marginale dans les forêts guinéo-congolaises est également décrit.

**Summary.** Observations made within the Guineo-Congolian region over 20 years show that three species of raptor are particularly vocal: African Goshawk *Accipiter tachiro* (all races), Congo Serpent Eagle *Dryotriorchis spectabilis* and Crowned Eagle *Stephanoaetus coronatus*, while Cassin's Hawk Eagle *Spizaetus africanus*, Long-tailed Hawk *Urotriorchis macrourus* and African Harrier Hawk *Polyboroides typus* sing less frequently. Congo Serpent Eagle and Long-tailed Hawk usually sing perched and mostly in the early morning, with a slight resurgence in late afternoon. African Goshawks sing mostly in flight and principally in the first half-hour after dawn. Large raptors with big territories (Crowned Eagle and Cassin's Hawk Eagle) sing during aerial displays concentrated in the warmer midday hours. Two species are clearly seasonal callers, African Goshawk and Congo Serpent Eagle, being active for periods of five or six months. The behaviour of other, less vocal species, or of species of more marginal occurrence in Guineo-Congolian forests is also described.

**M**any of the diurnal raptors of tropical rain forests are known to possess loud and characteristic vocalisations, used in territorial advertisement and / or courtship (Thiollay 1994), but the literature contains almost no quantitative studies of the vocal output of various species. In the Neotropics, mention can be made of short studies of two forest falcons *Micrastur* spp. (Thorstrom *et al.* 2000a, 2000b), and in south-east Asia, Kemp *et al.* (2011, Tables S5 & S6) have revealed seasonal and diurnal variations in vocal activity in a couple of species, mainly Crested Serpent Eagle *Spilornis cheela*. Some of the raptors inhabiting Guineo-Congolian rain forests are remarkably noisy, advertising their territories with loud vocal signals, whether from a perch, or in the course of aerial displays. Most of these vocalisations have been described in the standard literature (e.g. Brown *et al.* 1982) and are well represented on commercial recordings (Chappuis 2000). However, very little has been published on the behaviour associated

with territorial songs, including seasonality (the main exception being Gatter 1997 for Liberia), and almost nothing on daily variations in singing activity. This paper presents information on the singing behaviour of various species collected during opportunistic observations since the 1990s until the present. The six most vocal species are considered in detail; the behaviour of six others, either less vocal or of more marginal occurrence in the forest zone, is described more briefly. Mention is also made of the vocal behaviour of dependent immatures, which in some species can be very noisy and thus facilitate detection. Most observations come from visits to Congo-Brazzaville, totalling about two years, a series of shorter visits to Cameroon and more recently extensive work in West Africa (mainly Ghana). As population densities and singing activities of some raptors are related to forest types and local seasonality respectively, some details of the main study sites are presented first.

## Main study sites

1. Mayombe and Kouilou basin (southern Congo-Brazzaville). One three-week visit in the cold dry season of May–June 1989; six months (August 1990–January 1991) in the late dry season and early summer rains, the main rains starting in mid October. Main forest types: semi-evergreen and swamp forests.

2. Odzala National Park (northern Congo-Brazzaville). Thirteen months from late December 1993 to early April 1995, the only month not covered being June 1994. Odzala is on the equator and is subject to two dry seasons (a hot one about December–March, a cool one in June–August) and two rainy seasons, the main one being from late August to November, with a short one from late March to April or May. Annual rainfall measured at Odzala in 1994 was 1,500 mm; in 1993 the rains extended until December whereas in 1994 they finished abruptly in mid November. Main dry-land forest type is semi-evergreen, with a very open canopy; there are also broad swamp forests along rivers.

3. Nouabalé-Ndoki National Park (northern Congo-Brazzaville) and adjacent Lobéké, Boumba-Bek and Nki National Parks (south-east Cameroon). Several visits totalling nearly five months between November and May, in 1996–1999, the only month not covered within this period being February. These visits coincided with the main dry season (starting in December) and the start of the rains in April. In April–May rain showers are irregular, and the heavier rains take place later, until November. Annual rainfall was not known precisely, but is estimated to be in the region of 2,000 mm. Extensive swamp forests in Ndoki; dry-land forest in the whole region is semi-evergreen, with an open canopy.

4. Kupe and Manenguba to Mount Cameroon and Yabassi Hills (western Cameroon) and Monte Alen (Equatorial Guinea). Several visits totalling just over eight months in 1998–2001, covering the months of November–April, with a short visit 30 September–3 October 1998 (Kupe). The single rainy season lasts from late March to mid November, with annual rainfall much higher than in the east of the country. It is over 4,000 mm around Kupe (Bowden 2001), probably more in the Bakossis, but less in the Yabassi Hills. Mostly evergreen rain forest with a closed canopy, but

drier and tending towards semi-evergreen with a semi-open canopy in the Yabassi Hills.

5. Forest zone of south-west Ghana. About six months in evergreen and semi-evergreen rain forests between 2004 and 2010, covering the months of August–March. The main dry season is December to mid March, but there is a short dry season about July–August and annual rainfall approaches 2,000 mm (Grimes 1987).

6. Forest / savanna transition zone of eastern Ghana (Volta Region). A few months all east of the Volta, in January–early May, July and late October–November between 2004 and 2011. These semi-evergreen forests experience one main dry season, from December to March. Rains are intermittent in April–May, becoming heavy by June.

7. Gola Forest National Park (Sierra Leone). One visit of six weeks in the dry season of late January–February 2007. Evergreen rain forest with a single dry season from November to March and annual rainfall of approximately 3,000 mm.

8. Western Togo and southern Benin: one month in forests of Togo (covering parts of February 2010, March and May 2011) and two months in Benin (February 2009, April 2011). Weather patterns similar to eastern Ghana.

9. Nyungwe National Park (Rwanda). Five months in 1989–90. Montane rain forest, with extensive rainy season.

Table 1 shows the distribution of forest raptors encountered in the nine forest regions as defined above. Abbreviations used hereafter: N.P. = National Park; F.R. = Forest Reserve.

## Results

**Congo Serpent Eagle** *Dryotriorchis spectabilis*  
Guineo-Congolian endemic ranging from south-west Sierra Leone (Matru: Harrop 1961) to the Semliki Valley in western Uganda (Carswell *et al.* 2005). Until recently unknown from the Dahomey Gap but has been found in some dry forests of the transition zone of eastern Ghana (Dowsett-Lemaire & Dowsett 2007; pers. obs.) to the Togo border. One of the commonest forest raptors, especially in open-canopy semi-evergreen rain forest; also in swamp forest, mainly at edges and in broken canopy. Thus, three

**Table 1.** Distribution of diurnal forest raptors in the nine main study sites (numbered as above). x = present, (x) = rare or vagrant, - = absent.

**Tableau 1.** Distribution des espèces diurnes de rapaces forestiers dans les neuf sites d'étude principaux (numérotés comme ci-dessus). x = présent, (x) = rare ou accidentel, - = absent.

Species / espèces	Study sites								
	1	2	3	4	5	6	7	8	9
African Cuckoo Hawk / Baza coucou <i>Aviceda cuculoides</i>	-	(x)	(x)	(x)	(x)	x	-	x	-
Palm-nut Vulture / Palmiste africain <i>Gypohierax angolensis</i>	x	x	x	x	x	(x)	x	x	-
Western Banded Snake Eagle / Circaète cendré <i>Circaetus cinerascens</i>	-	-	-	-	(x)	(x)	-	x	-
Congo Serpent Eagle / Serpenteaire du Congo <i>Dryotriorchis spectabilis</i>	x	x	x	x	x	x	x	-	-
African Harrier Hawk / Gymnogène d'Afrique <i>Polyboroides typus</i>	x	x	x	x	x	x	x	x	-
Black Sparrowhawk / Autour noir <i>Accipiter melanoleucus</i>	x	x	x	x	x	x	x	x	x
Chestnut-flanked Sparrowhawk / Autour à flanc roux <i>Accipiter castanilius</i>	x	x	x	x	-	-	-	-	-
Red-thighed Sparrowhawk / Epervier de Hartlaub <i>Accipiter erythropus</i>	x	x	x	x	x	x	x	x	-
African Goshawk / Autour tachiro <i>Accipiter tachiro</i>	x	x	x	x	x	x	x	x	x
Long-tailed Hawk / Autour à longue queue <i>Urotriorchis macrourus</i>	x	x	x	x	x	-	x	(x)	-
Ayres's Hawk Eagle / Aigle d'Ayres <i>Hieraaetus ayresii</i>	-	-	x	-	x	x	-	x	-
Cassin's Hawk Eagle / Aigle-autour de Cassin <i>Spizaetus africanus</i>	x	x	x	x	x	x	x	x	x
Crowned Eagle / Aigle couronné <i>Stephanoaetus coronatus</i>	x	x	x	x	x	-	x	(x)	x

adjacent territories in a mixture of swamp and dry-land forest in Odzala N.P. measured *c.* 1 km<sup>2</sup> each (Dowsett-Lemaire 1997a): they consisted of galleries of forest 500 m wide and birds were often singing at distances of 2 km from each other. Two birds in riparian forest on the Afram River (central Ghana) were singing *c.* 1.5 km from each other; two birds answering each other at forest edges in Gola (Sierra Leone) were less than 1 km apart, as also in Oda River F.R. and Atewa Range F.R. in Ghana. It is unknown whether females sing as well, but I have never come across two birds calling in the same tree or in close proximity.

The species is not known to occur any higher than 900 m in West Africa (in Liberia, Gatter 1997). In Cameroon the highest records of calling birds were at 1,250 m (pers. obs. in Bakossi Mountains, and Ndokbou Forest in the Yabassi Hills), whereas Prigogine's (1971) collector obtained one as high as 1,800–1,900 m in Itombwe in eastern Congo-Kinshasa. Hunts from a perch at the edges of small clearings, roads and rivers, in open canopy (taking arboreal reptiles) or dropping to the ground to catch snakes, lizards and chameleons (Chapin 1932, Brosset & Erard 1986; pers. obs.).

Congo Serpent Eagles are most frequently located by their loud *kow* notes, uttered in a long series of about three in five seconds (Chappuis 2000) from a medium or tall tree. Songs can also be given during a low, fluttering flight as when a bird crosses a clearing to reach another song post,

but this is rare (pers. obs.). Another, less frequent vocalisation is a prolonged *kloooow*, lasting up to two seconds (first cut on Chappuis 2000). The short *kow* notes are far carrying and clearly possess a territorial content; neighbouring birds may counter-sing for long periods. A particular individual sings from different perches within its territory, and can switch from one to another in the same morning or from one morning to the next. A song series often lasts from a few to ten minutes, and can be repeated after breaks of ten or more minutes. Within the singing season (see below), a territorial owner can sing on several mornings in a row, whether near the beginning or towards the end of the season, but there are some days when it does not appear to sing at all, and possibly this may be related to breeding activities. The exact timing of singing bouts was noted on 128 occasions and peaks during early mornings: 74% of records fall in the first three hours after dawn (Table 2). Most of the later-calling birds were in cool environments (e.g. hills of western Cameroon, cold Harmattan weather in Ghana). Quite frequently some birds resume singing in mid to late afternoon (15% of observations), i.e. the last 2.5 hours of daylight. Finally, a few were heard mid to late morning and around noon. The long *kloooow* call has been heard on eight occasions only, and its significance is unclear; it could conceivably involve the female. It was heard mid to late morning (four times), once at noon, once in mid afternoon and, from two birds,

**Table 2.** Hourly production (from dawn) of singing bouts in five diurnal raptor species of the Guineo-Congolian forest zone, expressed as percentages.

**Tableau 2.** Production horaire (depuis l'aube) des chants chez cinq espèces de rapaces diurnes de la zone forestière guinéo-congolaise, exprimée en pourcentages.

Daylight hours	Species				
	Congo Serpent Eagle <i>Dryotriorchis spectabilis</i>	African Goshawk <i>Accipiter tachiro</i>	Long-tailed Hawk <i>Urotriorchis macrourus</i>	Cassin's Hawk Eagle <i>Spizaetus africanus</i>	Crowned Eagle <i>Stephanoaetus coronatus</i>
0-1	37.5	81.0	17.4	0	0
1-2	24.2	5.2	26.0	4.8	0
2-3	12.0	3.6	8.7	2.4	0
3-4	4.6	2.6	8.7	9.7	0
4-5	4.0	1.0	8.7	17.1	6.5
5-6	1.6	0	0	17.1	24.2
6-7	0	0.5	0	31.7	43.5
7-8	1.6	0	0	2.4	16.1
8-9	0	0	4.3	12.2	6.5
9-10	4.0	0	0	2.4	1.6
10-11	5.5	0.5	4.3	0	0
11-12	5.5	5.2	21.7	0	1.6
<i>n</i>	128	190	23	41	62

practically all day long (one at Odzala right at the end of the singing season on 1 February, one in Oda River F.R. (Ghana), on 27–29 November; its neighbour giving the normal song).

Fully fledged immatures may give a persistent, rising whistle, thinner than but nevertheless reminiscent of the whistles of African Harrier Hawk *Polyboroides typus* (Chappuis 2000). One young bird gave this call for a long time perched in a prominent tree on 4 June 1989 in the Mayombe, at a time when adults were completely silent. I have otherwise heard this call only twice: one in Semliki Forest (Uganda) on 4–5 March 1990 (one of two birds followed and well seen by R. J. Dowsett and T. Gullick), and one at Odzala on 3 November 1994, in a territory advertised by a singing adult. A. Hester (*in litt.* 2012) observed an immature call in Ankasa (Ghana) in early June 2005.

This species is a seasonal caller: the one full season measured at our base camp at Odzala lasted from 22 August 1994 to 1 February 1995 (covering the main rains and the first half of the hot dry season). But in the previous year (when the rainy season extended into December, see above), some birds sang until 20 February. The open-canopy Marantaceae forests at Odzala become crackling dry in the dry season, and most forest birds breed just before and during the main rains of September–November (Dowsett-Lemaire 1997b). Further north, in Ndoki and

adjacent south-east Cameroon, none was singing in November or early December as the rains were ending. The first one was heard on 24 December (1997, Nki) and from that day several birds were singing from late December into January. The song was last heard on 12 April (1996, Ndoki), with none at all in the second half of April or May (three visits to south-east Cameroon and Ndoki in April 1996, April–May 1997, April 1999). More fragmentary observations in southern Congo-Brazzaville, where the rainy seasons are reversed, showed birds to be vocally active in the dry season of August–October 1990, with only one singing once in the rains (19 December). None sang in the cold dry season of May–June 1989 in the Mayombe.

In western Cameroon the overall singing season lasts from December to mid April, i.e. from 29 November (near Kupe, 1998) to 17 and 22 April (Bakossi, 1998). None was recorded singing in the heavy rains of October and most of November. In Gola, Sierra Leone, birds were very active in the dry months of January–February (Dowsett-Lemaire & Dowsett 2008), and in general songs are heard throughout the dry season from November or December to March (A. Siaka pers. comm.). In Ghana, fairly extensive observations in the drier forests of the east of the country reveal a singing season extending from late October to late March, thus throughout the dry season. Extreme dates are 26 October (A.

Hester pers. comm., at Kalakpa in 2006) and 1 April (pers. obs., also at Kalakpa, in 2008). None sang in the rains later in May (Kalakpa) or in July (Kyabobo: Dowsett-Lemaire & Dowsett 2007).

In south-west Ghana, which has a bimodal rainfall regime, patterns are less clear. The species was heard in most months but vocal activity varied with location. In the Atewa Range it seems particularly noisy in August–February, with a lull in March–May; in several dry semi-evergreen forests such as Bobiri, Kwei Dabanyin (Winneba) and Sekondi, it is noisy in the dry season but not in August–September.

Thus, with the exception of Odzala, serpent eagles are vocal mostly in the dry season, especially in regions with a single, well-defined dry season. A full season at any one spot is likely to last no more than five or six months. The only previous reference to seasonality of calling was made by Chapin (1932) for Congo-Kinshasa, who noted that in the forests just north of the equator the breeding season extends from June to October or November (based on specimens), ‘the same period at which their voices are heard’; the species being silent in Ituri during the short dry season in January to March. This is a region with bimodal rainfall, as in Odzala.

### **African Harrier Hawk (Gymnogene)**

#### *Polyboroides typus*

This raptor occurs almost throughout the Afrotropics, except in the driest habitats, but it is most frequent in the forest zones and moist woodlands. Within the Guineo-Congolian and transition zone forests, it is more common in open-canopy, semi-evergreen and secondary forests than in closed-canopy, evergreen rain forest, and is also frequent in farmbrush. Its feeding habits are well known and need not be presented here, except to stress that in West Africa it is locally a great consumer of *Elaeis* palm nuts (Thiollay 1978). It produces a rising, somewhat whining whistle, *suweeeeew* (Chappuis 2000), given usually in undulating flight (with characteristic short, fluttering wingbeats), more rarely from a perch. This song is not very far carrying and territories are more often defended with silent aerial displays, by the male or both pair members (*cf.* C. J. Vernon & W. R. J. Dean *in* Hockey *et al.* 2005). In consequence, I have paid little attention to the species’ vocal behaviour, but did note the timing

of singing in 2009–11. For a total of 20 timed observations, birds were heard at all hours of the day except the first two and last hour, and with a slight peak (six, or 30%) 4–5 hours after dawn with less activity in the afternoon.

I have heard it in nearly all months of field work: at Kyabobo (Ghana) however, it was not calling on our first visit in July (peak of the rains) but was in the dry season (February). Gatter (1997) has noted some seasonality in Liberia, where it displays in August–November (late rains) and less intensively until March.

### **African Goshawk *Accipiter tachiro* (subspecies *canescens*, *toussenelii* and *macroscelides*)**

Widely distributed in all forest types of the Guineo-Congolian region and transition zones, being particularly common in the drier (semi-evergreen) types with open canopy. It occurs to at least 2,500 m in Cameroon (Mount Oku; pers. obs.). Densities have been estimated at one pair / km<sup>2</sup> in eastern Liberia (Gatter 1997). It feeds on birds, rodents, frogs, lizards or even large Coleoptera (Chapin 1932, Brosset & Erard 1986, Thiollay 1978), and is able to attack prey as large as Latham’s Forest Francolin *Francolinus lathamii* and African Green Pigeon *Treron calvus* (pers. obs.), White-crested Hornbill *Tropicranus albocristatus* (Chapin 1932) and domestic chickens. Other races occur in the forests and dense woodlands of eastern and southern Africa.

It is most surprising that Brosset & Erard (1986) wrote that in Gabon the taxon *toussenelii* is silent. I found all forest subspecies (*toussenelii*, *canescens* and *macroscelides*) as vocal as those of the *tachiro* group of eastern and southern Africa. A sonogram of the *kwip* display notes of *A. t. toussenelii* recorded in the Kouilou basin was published in Dowsett-Lemaire & Dowsett (1991) and shows the same general pattern as the *kwip* notes of South African birds (sonogram in Maclean 1985), with a basal note just above 1 kHz, although there are differences of detail. The *kwip* notes of *A. t. macroscelides* presented by Chappuis (2000) from Ivory Coast sound a little drier or lower pitched, and are reportedly identical to those of East African birds. Over such a wide range no doubt these *kwip* notes may show geographical variation, and more recordings are necessary to show also the possible extent of individual variation. Birds may sing perched but

do so more often in flight, in a display with wings quivering then gliding while the bird progresses in slow circles. Usually only one bird sings at any one spot, but sometimes two birds do so close to each other (often one perched, the other flying): they are probably pair members, as proven in south-east Africa (the female voice being apparently higher pitched: D. Allan *in* Hockey *et al.* 2005).

The precise timing of singing was not noted everywhere, but is known for 190 occasions. On 154 occasions (81%) birds sang in the first hour after dawn, mostly (all but 11) in the first half-hour of daylight. Vocal activity drops sharply thereafter, with a slight resurgence just before dusk (Table 2). Vernon (1986) showed a similar pattern for one territorial bird in the Eastern Cape studied for 11 months, with perhaps a wider spread of singing in the first three hours of the morning.

Birds in southern Africa are said to sing year-round, although Vernon (1986) showed a decrease of vocal output in the few months following breeding. I have too few dated records from Malawi for comparison, but birds in Nyungwe Forest, Rwanda (*A. t. sparsimfasciatus*) have an off-season lasting at least three months (Dowsett-Lemaire 1990). In 1990 the last song was heard shortly after we arrived, on 26 September, and the first one was noted on 25 December, after which song was regularly heard in January. The period October–December also coincided with the off-season of many forest passerines.

In the Guineo-Congolian region the singing season appears more reduced. In Odzala (*A. t. canescens*) the full season in 1994–95 lasted from August to January (song last heard on 23 January 1995). In the previous year the song was last heard on 28 January. No birds were heard singing in February–May or July (no data for June). In southern Congo-Brazzaville (*A. t. toussenelii*) song was heard August to January (including the summer rains), but none in May–June (no data for February–April or July).

In Ndoki and adjacent Cameroon birds sang December–January, but not much in April and only once in May (2 May). In western Cameroon and Equatorial Guinea song was heard from late December to mid March (none in April, October and November), but I have too few records overall to be sure of extreme dates. In Ghana song has been heard at all seasons overall, but there are local

variations. In Gola (Sierra Leone) birds were quite vocal in the dry months of January–February, and similarly in Liberia, Gatter (1997) noted a singing season mainly in the dry months, November–March in one locality, and January–March in another.

The Congo data reveal that the singing season is limited to *c.*6 months, ending just before that of Congo Serpent Eagle. In Cameroon and most of West Africa (though not in Congo-Brazzaville) singing is centred on the main dry season.

### **Long-tailed Hawk** *Urotriorchis macrourus*

Guineo-Congolian endemic ranging from Sierra Leone (Kambui Hills: Okoni-Williams *et al.* 2001) to Bwamba Forest in western Uganda (Carswell *et al.* 2005). An inhabitant of moist evergreen and semi-evergreen rain forests of the region, absent from drier forest types of the forest / savanna transition zone. Very little is known about the feeding behaviour of this discreet raptor, except that it may attack poultry (Chapin 1932), take flying squirrels (*Zenkerella insignis*: Bates 1930), squirrels of the genus *Funisciurus* (Brosset & Erard 1986) or *Heliosciurus* (pers. obs.), and its foot structure suggests the species is a mammal hunter (Brosset & Erard 1986).

Long-tailed Hawk is most frequently detected by its loud, distinctive mewing *kweeeuw* or *kweeu-eeew* lasting up to two seconds (Chappuis 2000; sonogram in Dowsett-Lemaire & Dowsett 1991). Playback provokes a territorial (vocal) reaction (pers. obs.; N. Borrow *in litt.* 2008). The fully fledged immature is very vocal, giving series of three or four shorter *weeue* notes from a perch (at a rate of one per second: Chappuis 2000).

Adults sing mainly from a tall perch in forest, but also in flight. There is no aerial display. On four occasions, I saw two adults sing together, either in flight or perched in the same or neighbouring trees, without any form of aggressive interaction (Congo-Brazzaville, Cameroon and Ghana). N. Borrow (*in litt.* 2008) has also seen two adults sing together (Gabon). Thus, there is little doubt that both pair members are vocal. There was no occupied territory close to our base camp at Odzala, but limited data suggest the species sings at all seasons, as elsewhere in its range. The overall impression, however, is that vocal advertisement is not as regular or as frequent as in other species. In places, I have heard bouts of singing on

three consecutive days (e.g. mid January in the Mayombe). The longest singing bout I witnessed lasted 45 minutes (Gola, Sierra Leone, 1 February 2007), when a rufous-bellied bird sang from atop an emergent tree from 18.00 hrs onwards. This pair had a noisy, fully fledged immature.

The timing of adult songs (noted precisely on 23 of 36 occasions) shows a peak in the first two hours of daylight and the last hour before dark (Table 2). Immatures are persistently noisy, probably for a duration of several months: thus, in the Mayombe, a young bird was calling in mid September and was still calling in the same area on a second visit in late November–early December. In Ghana and elsewhere immatures have been heard at all seasons.

The only reference to the (lack of) seasonality of singing mentioned in the literature is by Gatter (1997) for Liberia, who wrote ‘high calling activity also outside breeding season May–August’.

**Cassin’s Hawk Eagle** *Spizaetus africanus* (now considered an *Aquila*: Haring *et al.* 2007)

Previously a Guineo-Congolian near-endemic, ranging from Sierra Leone (Western Area Peninsula: Okoni-Williams *et al.* 2001) to western Kenya (Clarke & Edelstam 2001) and Rwanda-Burundi, but since its discovery in the Udzungwa Mountains of Tanzania (Jones 2007), it becomes a Guineo-Congolian / Afromontane species. This small eagle reaches high altitudes in the Albertine Rift, occurring to 2,500 m in Nyungwe Forest in Rwanda (Dowsett-Lemaire 1990), and throughout the highlands of Cameroon, to at least 2,300 m, on Mount Oku (Stuart 1986). It is generally widespread in lowland rain forest (evergreen and semi-evergreen) but can be qualified as common mainly in hills and mountains. It does penetrate drier forests of the forest / savanna transition zone in the Dahomey Gap, and indeed is more conspicuous in the hills of eastern Ghana and western Togo than in the lowlands of the Guineo-Congolian forest zone of south-west Ghana (pers. obs.). Its feeding habits are poorly known. Recent observations in Ghana include one catching a bird (pers. obs.) and a snake (N. Borrow *in litt.* 2011); the stomach of a specimen contained a bird (Chapin 1932) and two different individuals flushed from the forest floor each had a large squirrel (probably *Heliosciurus*) in their claws (Brosset & Erard 1986); the latter authors remark

that foot morphology suggests it is mainly a mammal hunter.

This eagle has a noisy aerial display, albeit on a discreet scale compared to that of Crowned Eagle *Stephanoaetus coronatus*. The song, a distinctive *ku-ku-wee, ku-ku-ku-wee*, lasting just under one second, was only described in 1990 (Dowsett-Lemaire 1990, with sonogram). Some variants may contain a few more short notes *ku-ku-ku-*, before the *ku-wee*, and I have also heard a *klee-eeep, klee-eeep* from a flying adult. The only call described in Brown *et al.* (1982), where attributed to I. R. Taylor, is a long, high scream lasting 1–2 seconds, which I have never heard from this species and which might better fit Long-tailed Hawk, except that it was said to be given by a bird soaring over forest. Borrow & Demey (2001) also mention a high-pitched whistled *weeee-eh* given from a perch, presumably based on a recording by S. Keith included in Chappuis (2000). This is of about one second duration; no locality is given, but it must come from West Africa (probably Liberia, visited by S. Keith in 1971) as the background noise includes the typical West African song type of Yellow-spotted Barbet *Buccanodon duchaillui*. Macdonald & Taylor (1977) also mention an adult in Ghana calling persistently from a perch, without describing the call.

The song of (normally) three or four notes is usually repeated a few times at short intervals while the bird soars over the forest or flies in a straight line with short, fluttering wingbeats. The aerial singing display attributed to Black Sparrowhawk *Accipiter melanoleucus* in Brosset & Erard (1986: 42) in fact applies to this species (C. Erard *per* C. Chappuis *in litt.* 1998). Playback of song given by a bird in the Bakossi Mountains provoked the caller to dive, still singing, into the canopy towards the tape.

Display songs carry much less distance than those of Crowned Eagles, and it is difficult to know how regularly a particular bird may call. In a known territory at Odzala song was heard on only seven of 35 day or morning visits, but there is no doubt that the territory extended beyond my research area. The longest singing output was over a period of more than two hours, the bird having started at 11.45 hrs, continued almost non-stop to 12.10 hrs, and was still singing when I re-crossed the area at 14.00 hrs (Yabassi Hills, 11 January 2001). The exact timing of singing was not noted

everywhere, but based on 41 observations it is quite spread out, although it shows a peak (66%, Table 2) from late morning to noon (i.e. 10.00–13.00 hrs where dawn starts around 06.00 hrs).

The general impression is that there is no marked seasonality of singing as songs have been heard in all months. The only reference to singing seasonality in the literature is by Gatter (1997) in Liberia who also noted display songs in practically all months (September–February, April and June).

Several Turdidae have been heard imitating the song of this raptor in their own songs, including Crossley's Ground Thrush *Zoothera crossleyi* (Mount Nlonako, Cameroon), Snowy-crowned *Cossypha niveicapilla* and Red-capped Robin Chats *C. natalensis* (Mayombe), Snowy-crowned Robin Chat also in eastern Ghana, and West African Thrush *Turdus pelios* in eastern Ghana (from Kyabobo to Amedzofe).

### **Crowned Eagle** *Stephanoaetus coronatus*

This species has an extensive range throughout the Guineo-Congolian forests and beyond to eastern Africa, north to Ethiopia and south to South Africa. In the forest zone it is the only avian predator of medium-sized mammals, and primates (*Cercopithecus*, *Colobus*, *Mandrillus*) are the main prey (e.g. Chapin 1932), but forest duikers *Cephalophus* spp. are also taken frequently, and eagles are reported to regularly visit lines of traps set by hunters to consume what is caught (Brosset & Erard 1986). The list of other prey items given by Brosset & Erard shows great eclecticism: Pangolins *Manis tricuspis*, Forest Porcupines *Atherurus africanus*, large squirrels *Protoxerus stangeri*, Tree Hyrax *Dendrohyrax dorsalis* and Genet *Genetta servalina*. At Lobéké marsh (Cameroon) one caught a Straw-coloured Bat *Eidolon helvum* from a roost in *Raphia* (pers. obs.). Densities can be relatively high (thus, five pairs along 100 km of the Ivindo River in Gabon: Brosset & Erard 1986), but it has become very scarce in areas where monkeys, and indeed the eagle itself, have been heavily hunted, e.g. the Mayombe (Dowsett-Lemaire & Dowsett 1991), or parts of Liberia (Gatter 1997).

The display songs and breeding biology of this most vocal of African raptors have been well described in eastern Africa: usually one, sometimes both adults give a far-carrying *kewee-kewee-kewee-kewee...* while rising and falling in

undulating display flight (e.g. Brown *et al.* 1982). Dependent, fledged juveniles are also very noisy (*kee-kee-kee-kee-kee* given in series), for extensive periods of time. Observations in the Guineo-Congolian forests concur with the general pattern of a midday caller. Of 62 timed observations, the earliest displays were heard 4.5 hours after dawn; there is a clear peak, with 84% of birds singing in the three midday hours (Table 2). This means that in an area where dawn is around 06.00 hrs, the main period of activity is between 11.00 and 14.00 hrs.

I have heard Crowned Eagles display in all months, but I do not have enough information from during the heavy rains to detect possible seasonal variation. Gatter (1997) for Liberia noted 'call activity high December–May (–July)', centred on the dry season and first half of the rains. Bowden (2001), at Kupe, Cameroon, noticed displays in January–April, centred on the dry season and early rains, but Faucher (1999) heard them display in the very wet, adjacent Bakossi Mountains between May and July, during the peak rains. In south-west Ghana it has been heard in all months (pers. obs.).

Robin Chats *Cossypha* spp. frequently include the song of this eagle in their songs throughout eastern Africa; this is also true of *C. niveicapilla* in Congo-Brazzaville. In Ghana and elsewhere I have no such observations, but *C. niveicapilla* does not penetrate the forest zone, and Blue-shouldered Robin Chat *C. cyanocampter* is mainly in thicket or transition forest, being largely allopatric with the eagle.

### **Other raptors**

African Cuckoo Hawk *Aviceda cuculoides* is infrequent in Guineo-Congolian forests, occurring mainly in clearings (as along large rivers) or in second growth outside. Brosset & Erard (1986) had no personal observations in north-east Gabon in 20 years, and I saw it only once at Odzala in 13 months. In Ghana it is not uncommon in some of the drier forests of the forest / savanna transition zone (e.g. Kalakpa), and its song is given frequently in the late dry season, from February to early April. In late March 2008 at Kalakpa the distinctive *tictictic-tuweeu* song was given persistently, at different times of the day, by one bird perched in a tall *Ceiba*, and a second bird was singing in another *Ceiba* 250 m distant.



Songs were also occasionally performed in flight over the forest canopy. It is also fairly frequent in the forest / savanna transition zone of southern Benin, singing regularly in February–April. The literature dealing with this species in eastern and southern Africa does not clearly refer to seasonality of singing (e.g. Hockey *et al.* 2005). In the woodlands of northern Ghana they sing most frequently from March to May, with the very first rains.

Western Banded Snake Eagle *Circaetus cinerascens* is widespread in savanna regions of Africa, mainly in riparian situations. It barely penetrates the forest zone, having been encountered in the transition zone of western Ghana (Tain Tributaries II F.R.), eastern Ghana (Odomi River F.R.) and southern Benin (Lama Forest and some drier forests to the north), at localities from which Congo Serpent Eagle is absent. Like its close relative, Southern Banded Snake Eagle *C. fasciolatus* of eastern Africa, it has a loud territorial song (*kwaaagh, kokokokokowe*). This is usually given in aerial displays during the hot midday hours, more rarely when perched in the early morning: thus a bird at Odomi was singing in flight six hours after dawn on 24 March 2009, but also from a perch the next morning 40 minutes after dawn. At Tain Tributaries II one was singing 25 minutes after dawn. In Lama one was singing four and just over five hours after dawn (respectively February 2009, April 2011, in the same territory).

Of the other three *Accipiter* species frequenting Guineo-Congolian forests (Black Sparrowhawk, Chestnut-flanked Sparrowhawk *A. castanilius*) or mostly its edges (Red-thighed Sparrowhawk *A. erythropus*), none has a display or territorial song, although Black Sparrowhawk at least can be noisy in the vicinity of nests. I have seen Red-thighed Sparrowhawk call on only two occasions in Ghana (perched), and equally rarely elsewhere: a pair or individual frequently hunting lizards around our house at Odzala was completely silent. The voice of Chestnut-flanked Sparrowhawk is undescribed.

Ayres's Hawk Eagle *Hieraaetus ayresii* is, much like African Cuckoo Hawk, generally absent from the wet block of evergreen rain forest, and is considered uncommon in semi-evergreen rain forest, including drier types in the forest / savanna transition zone. Gatter (1997) reckons it has extended its range south in Liberia through

deforestation. Quite unlike its relative, Cassin's Hawk Eagle, this species has no territorial song, and the impression of scarcity may also be due to unobtrusiveness.

Finally, Palm-nut Vulture *Gypohierax angolensis*, a widespread bird of rain forest and drier riparian forest usually associated with *Elaeis* and *Raphia* palms, has a highly stereotyped 'song', not described accurately in the literature before 2003. Based on a study of captive birds in a Paris zoo, Schlee & Iorgulescu (2003) described this vocalisation, a strange, gurgled *ur-urrrrr* (a bark followed by a prolonged growl, which I would transcribe as *kwak-urrrrr*). It was given mainly by the female in territorial defence as well as when interacting with her mate, and is accompanied by a postural display, with head and chest lowered. The nesting male may also give a modified version of this (not tape-recorded by them), either shortened or with the first note replaced by the contact call. At Odzala we were encumbered with a tame subadult of unknown sex during the year and a half we lived there, and it gave the *kwak-urrrrr* frequently when going to roost in the evening, occasionally at other times of the day. It used to spend the night on the radio antenna above the office and typically gave one song before roosting. I did not record it (mainly as it was given only once) but was nevertheless surprised to note that Chappuis (2000) did not include it. It does not carry far, and I have not heard it more than very occasionally in other forest localities (e.g. Ankasa in Ghana, near an occupied nest). Bates (1930) often heard a bird that used to nest near his home in Cameroon giving 'an explosive bark followed by a deep guttural growl', which certainly refers to the same song. Brosset & Erard (1986) once saw members of a pair calling to each other in flight, one giving an accentuated *kwaaak* and the other a longer gurgling or guttural sound; this is rather odd, as they seem to describe the two parts of the call usually given by a single bird.

### Conclusion and discussion

Of the five most vocal forest raptors, two are mainly perch-callers (Congo Serpent Eagle and Long-tailed Hawk), while three sing in aerial displays (African Goshawk, Cassin's Hawk Eagle and Crowned Eagle). Congo Serpent Eagles sing mainly in the early mornings, and some again in the afternoon, much like insectivorous birds:

they sing at times that cannot be profitably spent hunting since their prey is more active in the warm hours of the day. African Goshawks are also most active in the early morning and especially around dawn, but larger raptors using display flights require thermals to save energy and sing mainly in the hot, midday hours. This is especially true of the heavy Crowned Eagle, and also, to some extent, of the medium-sized Cassin's Hawk Eagle. H. Rainey (*in litt.* 2012) adds that Crowned Eagles may also use the midday hours for singing as these may be less favourable for hunting. This is more difficult to prove: the variations in hunting activity and success during the day have not been studied, and monkeys (the favourite prey) tend to go into torpor during the hot hours of the day. This may in fact make them less alert to the dangers of predation.

Two species show marked seasonality of singing, African Goshawk and especially Congo Serpent Eagle, in which the calling season lasts 5–6 months, probably coinciding with the breeding season (*cf.* Chapin 1932, Dowsett-Lemaire 1997b). This suggests that in these species territorial defence can be relaxed for about half the year. It is odd that congeners of some noisy species do not possess a territorial vocal display (e.g. Black Sparrowhawk and Ayres's Hawk Eagle). Similarly, Palearctic species of *Accipiter* lack territorial songs (*pers. obs.*; Cramp 1980).

The marked seasonality of singing in Congo Serpent Eagles is a problem for bird censusing in Guineo-Congolian forests, as this raptor is a perch-hunter that can easily be overlooked when silent. The strong variation in singing output during the day in all species also inevitably will influence detection of these birds.

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- Le Pouget, Sumène 30440, France. E-mail: Dowsett@aol.com*
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- Appendix.** Gazetteer of localities cited (N.P. = National Park; F.R. = Forest Reserve).
- Annexe.** Répertoire des localités citées (N.P. = Parc National ; F.R. = Réserve forestière).
- Benin**  
Lama Forest .....06°59'N 02°05'E
- Cameroon**  
Bakossi Mountains .....05°00'N 09°40'E  
Boumba-Bek N.P. ....02°40'N 15°00'E  
Kupe Mountain .....04°48'N 09°40'E  
Lobéké N.P. ....02°15'N 15°45'E  
Mount Nlonako .....04°50'N 10°00'E  
Mount Oku .....06°10'N 10°30'E  
Nki N.P. ....02°15'N 14°30'E  
Yabassi Hills .....04°30'N 10°15'E
- Congo-Brazzaville**  
Kouilou basin .....04°40'N 11°50'E  
Nouabalé-Ndoki N.P., or 'Ndoki' .....02°20'N 16°30'E  
Odzala N.P. ....00°30'N 14°45'E
- Equatorial Guinea**  
Monte Alen N.P. ....01°40'N 10°15'E
- Ghana**  
Afram River (Kogyae) .....07°10'N 01°07'W  
Amedzofe .....06°50'N 00°26'E  
Ankasa Resource Reserve and N.P. ....05°18'N 02°38'W  
Atewa Range F.R. ....06°10'N 00°35'W  
Bia N.P. ....06°35'N 03°05'W  
Kalakpa Resource Reserve .....06°25'N 00°20'E  
Kyabobo N.P. ....08°25'N 00°35'E  
Oda River F.R. ....06°05'N 01°53'W  
Odomi River F.R. ....07°21'N 00°29'E  
Tain Tributaries II F.R. ....07°30'N 02°26'W
- Rwanda**  
Nyungwe Forest N.P. ....02°30'S 29°15'E
- Sierra Leone**  
Gola Forest N.P. ....07°30'N 11°00'W  
Kambui Hills .....07°55'N 11°17'W  
Mattru .....07°16'N 12°07'W  
Western Area Peninsula .....08°23'N 13°10'W
- Uganda**  
Bwamba Forest, Semliki N.P. ....00°52'N 30°05'E